Linking Primary Care Information Systems and Public Health Vertical Programs in the Philippines: An Open-source Experience

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Abstract

Community-based primary care information systems are one of the building blocks for national health information systems. In the Philippines, after the devolution of health care to local governments, we observed "health information system islands" connected to national vertical programs being implemented in devolved health units. These structures lead to a huge amount of "information work" in the transformation of health information at the community level. This paper describes work done to develop and implement the open-source Community Based Health Information Tracking System (CHITS) Project, which was implemented to address this information management problem and its outcomes. Several lessons learned from the field as well as software development strategies are highlighted in building community level information systems that link to national level health information systems.

Keywords:
Public health informatics, information management, primary health care, community networks

Introduction

The delivery of health care services in the Philippines was devolved to local government units in 1998 under the Health Sector Reform Agenda (HSRA) carried out by the Department of Health [1]. In the course of the devolution, there was not enough time to cede health information management functions to local government units (LGUs) for them to carry out data collection, integration and presentation in a seamless, distributed and coordinated manner. National vertical health programs remained in place, however, each with its own complement of logbooks, and reporting forms and protocols, and sometimes personnel. The Philippine vertical programs include among others, Child Care and Development, Maternal Care, the National TB Program, Family Planning, and the Expanded Program for Immunization. In busy community health centers, data entry of patient information over several logbooks can be inefficient and is characterized by redundant and inaccurate entries. As early as 1995, a case study of Philippine public health information systems by Jayasuria revealed proliferation of reports consuming 40% of the time of field personnel, high levels of duplication and delays due to manual processing [2], a situation that has persisted to the present. Currently, there are no data quality control and validation procedures where paper forms are used and community health workers generally do not get feedback from reports that they submit. The collection of large amounts of health data without feedback to the collectors seems to be the practice not only in the Philippines but in other settings where national vertical programs are used [3]. Vertical programs are generally useful particularly when there is a need to urgently address a public health problem like HIV-AIDS [4, 5] and smallpox [6] because they can achieve economies of scale and focus resources and manpower on a specific problem. To make information management efficient and to ensure a good supply of quality information, we needed to integrate existing interfaces to vertical programs at the community level, as we work our way upwards for higher level integration of information systems at level of the city health office.

In addition to the information management situation above, an alarming trend is emerging in the Philippine health care scene. As early as 2003, thousands of physicians nationwide, including an undetermined number of government physicians, have been retraining as nurses to become part of the eligible health workforce migrating to developed countries [7, 8]. Intra- and inter-country migration of health workers potentially compromises the quality of health service delivery by creating uneven distributions of providers in relation to populations [9]. The scenario of having health centers without doctors required that the community-based information system should be usable by community-based or indigenous health workers.

It is in this context that in 2003 we conceptualized the project and submitted a proposal for funding to PANASIA-ICT [10][1] to implement the Community Health Information Tracking System, or CHITS (http://www.chits.info), a primary health care information system. The backdrop of this proposal is a bigger goal to build a national health information infrastructure within the next five years. The community-based information system can contribute to

[1] PANASIA is a joint funding activity of the United Nations Development Program (UNDP) and the International Development Research Centre of Canada (IDRC).

this bigger goal by improving information management at the community level.

We deemed the following four objectives important for project success:

1. To design and develop a generic, reusable, open-source framework for community health information systems used in primary health care
2. To determine the feasibility of integrating vertical programs at the community level.
3. To enable and empower community health center staff to use this community based health information system through the development of certificate training courses for community-based data managers.
4. To harness community resources for the sustainability of health information management activities

2. Methods

Lorenzi enumerated four cornerstones of health informatics [11] and we deemed it important to embellish these to address the objectives above as follows:

Cornerstone 1: Producing structures to represent data and knowledge so that complex relationships may be visualized. To develop a generic, reusable, open-source framework for primary care level information systems (first objective) and integrate vertical programs at the community level (second objective), we needed to: (1) create an information system architecture based on conceptual data models revolving around national vertical programs and primary health care services at the community level; (2) build software functionality around data models directly related to health care services and vertical programs; and, (3) design this architecture such that it protects the health information system from extensive code and database revisions that may arise without software modularity.

Cornerstone 2: Developing methods for acquisition and presentation of data so that overload can be avoided. To carry out integration of data collection, integration and presentation activities of the different vertical programs at the user interface level and eliminate paper reporting (second objective), we needed to examine all health center forms and logbooks identified with the different vertical programs and subsequently map out intersecting and unique data elements for each program.

Cornerstone 3: Managing change among people, process and information technology so that the use of information is optimized. To empower community health center staff (third objective), we needed to: (1) determine work motivation factors; and (2) immerse ourselves in the milieu of health center activities for six weeks. To meet the fourth objective, aside from building rapport and a working relationship with the local government units, we needed to: (1) set up partnerships with external resources to create a "bandwagon effect"; and, (2) build external alliances around the project to create an ecosystem of similar applications that support project objectives.

Cornerstone 4: Integrating information from diverse sources to provide more than the sum of the parts and integrating information into work processes so that it can be acted upon when it can have the largest effect. To address the first and second objective, we needed to (1) employ modular, object-oriented software development methods and adapted open-source software created by other developers for integration; (2) model the application from health center workflows and consider the paper-based forms and logbooks as our closest "competition"; and (3) design the application to support vertical and horizontal health information exchange, and incorporate report-generation features to make sure community health workers can make use of the health data that they generate at their level.

To develop and implement CHITS, these methods were applied to two health centers (Lagrosa and Malibay) each with an average coverage of 10,000 families and located in a progressive local government unit with which our university had established a memorandum of understanding.

Results

We describe the project outcomes below according to the objectives previously enumerated.

To design and develop a generic, reusable, open-source framework for primary care level health information systems. One of the obstacles we faced was how to deploy an information system in three months for a nine-month long project. We had earlier developed a modular information system architecture called the Generic Architecture for a Modular Enterprise (GAME) Engine [12] that can serve as an applications development platform for other software development projects. The GAME Engine runs on Linux, Apache Web Server, MySQL database and the PHP Scripting Language. The GAME Engine makes extensive use of previously published open-source code libraries like JPGRAPH for object-oriented graph display and FPDF, a PDF-generation engine for creating the summary reports. Using this platform, software development was carried out, resulting in the development of 44 software components together with lookup data libraries, including ICD10 Diagnosis Coding. Among these modules is a Clinical Reminders module that enables health center staff to send mobile phone short messages (SMS), which are generated from system templates, and sent to patients to remind them of follow-up visits and encourage compliance

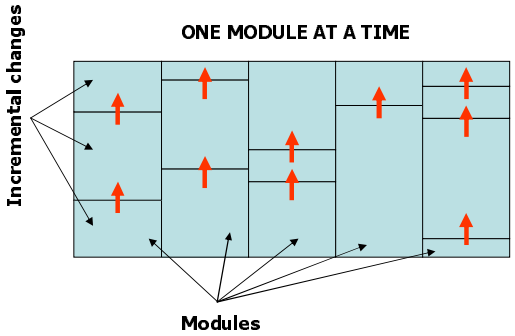

Figure 1 - Modular and incremental software development (adapted from Heeks [13])

with medication intake. New software modules, software upgrades and data dictionaries are uploaded as compressed files and automatically incorporated into the system. The CHITS application currently runs in an intranet environment with a Pentium 4 class server and 3 scaled down Pentium 4 workstations costing about

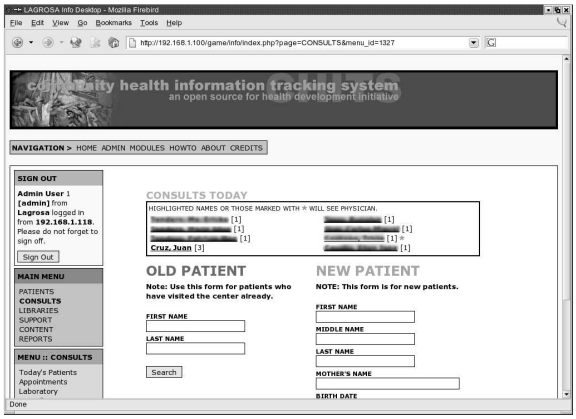

Figure 2 - CHITS consult page showing patients who have arrived for health center services. The highlighted name belongs to a patient who has been flagged for referral to health center physician, an innovation suggested by health center staff. Strong identifiers have been blacked out.

$1,900 at 2003 hardware prices. For the first time, submission of electronic reports has become part of the health ministry procedures for quality accreditation.

To determine the feasibility of integrating vertical programs at the end user level. To integrate the vertical program "information system islands," we used the incremental development approach [13] (Figure 1), developed a single interface for vertical program modules, and integrated report generation tools to the end-user (Figure 2). Figure 3 shows how modules are positioned in the GAME architecture. We involved the health center staff in interface development, and successfully streamlined their health center workflow using CHITS. The indigenous health workers now interface with public health vertical programs using the CHITS interface. Most importantly, we were able to eliminate "paper forms" by six months by working on reports generated by each vertical program.

To enable and empower health center staff to use this community based health information system through the development of a professionalized training course for community-based data managers. We studied health center culture and social organization using a scaled down ethnographic approach [14, 15] and worked with health center staff for six weeks. One of the obstacles we faced was the lack of confidence of indigenous health workers on their ability to use IT. We were able to build relationships and an environment of mutual trust, enabling us to have smooth interactions with the health center staff. We incorporated capacity building to present a benevolent face to potential and obstinate change management areas, such as quality-adverse data habits (Figure 4). The end users became effective trainors themselves, proudly showing off not only their certificates but also their skills. This provided us with a possible solution to the problem of training staff from other health centers through "on-the-job" training offered in centers in advanced stages of training. This also enables us to

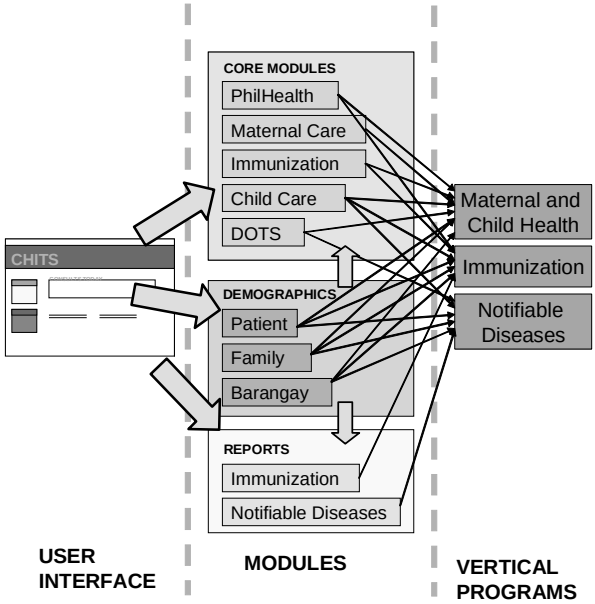

Figure 3 – Vertical programs in the third column map to CHITS modules in the middle column, which the end user interacts with using a single, unified interface.

develop cohorts of technically-enabled end-users (Figure 5). Except for the health center physician module, community health workers ran most of the software modules from health center workstations. We decided to postpone development of other modules, like the clinical module, in lieu of the ones most needed to automate and integrate vertical programs, to make CHITS immediately useful and alleviate health workers of the report generation burden.

To harness community resources for the sustainability of health information management activities. We were also able to create strategic alliances around CHITS to overcome the lack of momentum in integrating health information systems and lack of awareness about how different public health information systems can be made to work using a collaborative approach. One example is the Tuberculosis (TB) registry vertical program which attracted the Philippine Coalition Against TB (PhilCAT), a well-funded implementing arm of the WHO Directly Observed Therapy for Short-Course Strategy chemotherapy (DOTS) for tuberculosis control. Between July and August 2004, two demonstration sessions were conducted for the city health offices of two neighboring local government units (the cities of Parañaque and Marikina). These LGUs have subsequently initiated CHITS deployment and secured their own internal and external funding. In the hardware area, the Advanced Science and Technology Institute (ASTI, http://asti.dost.gov.ph/) of the Department of Science and Technology (ASTI, a government agency) developed a plug-in PC card that incorporates a GSM modem which enables CHITS to send clinical reminders and receive data by Short Messaging System (SMS). To support and complement CHITS implementation, we proposed two other projects to the national government: the National Telehealth Project, called *BuddyWorks*, and the Philippine National Health Information Infrastructure Project, to link health information stakeholders and

Figure 4 – Training of community health workers

enable information exchange. Both projects were subsequently considered for funding, with *BuddyWorks* now in the implementation phase, through the e-government program of the national government and actually form part of the initial activities of the emerging Department of Information and Communications Technology.

Discussion

Designing community-based health information systems is a challenging task that involves simultaneous work along technical, social, political, and financial fronts. Chandrasekhar enumerates systemic constraints related to a developing country's economic status that are breeding grounds for skepticism towards the potential of information and communications technologies (ICTs) to have a positive

Figure 5 – Encounter with health center nurse who also acts as system administrator

impact on health services delivery. First, an overwhelming majority is likely not to have access to technology. Second, inadequate education would ensure people do not have adequate levels of competence or confidence to take part in transformational activities [16]. By using the rich library of open-source tools available online, by integrating capacity building, and harnessing external, national and local government political and funding support, we hope to have addressed these systemic constraints.

In this project, we have developed a generic, reusable, open-source framework and a community-based health information system that integrated vertical programs at the community level. There are three lessons we learned from this project: First, by paying close attention to health center culture and immersing ourselves in the end-user's social context, we captured an accurate model of their organizational and personal realities, and were able to gain insight into their needs and requirements. We then applied these insights, together with the health center information and data model, into software code – in a process called *evolutionary software development* using a modular approach with incremental introduction of change [13]. These insights were also applied to the design of a certificate data management course for community health workers that brought out their potential to be able to manage the change brought about by technology and allowed us to "indoctrinate" them about the importance of data quality and the bigger information ecosystem where health center data and information belong. Second, open-source software, aside from enabling us to decrease implementation costs, provided an environment for software code transparency for peer-review purposes and fostered shared learning. Traditional proprietary software development otherwise hides internal processes as it

happens in a software "blackbox." Third, we discovered that it is important to have a heightened awareness of the "ecosystem" in which the health information system will function. Included in this ecosystem are the people who will make it work (community health workers), the people who make things possible, logistically and politically, and the enabling environment to use the system and derive benefits from it.

In the end, implementing this system became a battle for "hearts and minds" as we created and managed change in implementing a community-based health information system, first, by looking at how the people involved viewed things from their perspective, and then by giving them the tools to manage the change.

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